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THE Journal of the Society of Arts, AND OF

THE INSTITUTIONS IN UNION.

110TH SESSION.]

FRIDAY, FEBRUARY 26, 1864.

[No. 588. VOL. XII.]

Announcements by the Council.

ORDINARY MEETINGS.

Wednesday Evenings, at 8 o'clock.

MARCH 2.—“On the Verification of Olive Oil, by means of its Cohesion Figure.” By CHARLES TOMLINSON, Esq., Lecturer on Science at King's College School. On this evening ROBERT BENTLEY, Esq., Professor of Botany in King's College, London, will preside.

MARCH 9.—“The Science of Fish-hatching.” By FRANK BUCKLAND, Esq., M.A., F.Z.S., late 2nd Life Guards.

MARCH 16.—“On the Organisation of the Corps Impérial des Ponts et Chaussées in France.” By GEORGE R. BURNELL, Esq.

CANTOR LECTURES.

The fourth lecture of Mr. Burges's course will be delivered on Monday next, at eight o'clock.

FEB. 29.—LECTURE IV.—*Iron and Brass*.—Antique bronzes; Mediæval ditto; modern French bronzes (Barbédienne); Mediæval dinanderie; modern ditto (Hardman, Hart, &c.); Mediæval and Renaissance wrought iron; modern ditto; cast iron.

MAR. 7.—LECTURE V.—*Gold and Silver*.—Antique and Mediæval plate; modern ditto (Elkington); Antique and Mediæval jewellery; modern ditto; Antique and Mediæval coinage; modern ditto.

MAR. 14.—LECTURE VI.—*Furniture*.—Mediæval furniture, oak and painted; Renaissance; 16th and 17th centuries; modern.

MAR. 21.—LECTURE VII.—*The Weaver's art*; Mediæval, Eastern, modern.

INSTITUTIONS.

The following Institution has been received into Union since the last announcement:—

Stockport Mechanics' Institution.

SUBSTITUTES FOR GUTTA PERCHA.

Sir W. Holmes has forwarded to the Council, from Demerara, some specimens of a gum termed “Balata,” the produce of the Bullet tree (*Sapota Mulleri*), which grows in that colony, and which, he states, possesses the properties of gutta-percha, and may be used as a substitute for it. The specimens include not only the inspissated juice, but also a bottle of the juice itself. Mr. Ondaatje, colonial surgeon, has forwarded to the Council, from Ceylon, a specimen of the *Alstonia Scholaris*, which he states may be used as a substitute for gutta-percha. It is stated to possess the same properties and is as workable as the latter. It readily softens when plunged in boiling water, is soluble in turpentine and chloroform, receives and retains impressions permanently, and is adapted for seals to documents. The tree abounds with milky juice, like the gutta-percha, has a fleshy bark and porous wood, and belongs to the natural order Apocynæa. The

natives believe that the tree is very poisonous, and class it among their virulent poisons, but Mr. Ondaatje states that his experiments with the juice, &c., have proved the contrary. These specimens are sent in response to premiums offered by the Society for the discovery of a substitute for gutta-percha.

Proceedings of the Society.

CANTOR LECTURES.

FINE ARTS APPLIED TO INDUSTRY. By W. BURGES, Esq.

THIRD LECTURE, MONDAY, FEB. 22.—POTTERY.

Mr. BURGES began by remarking that the history of pottery had been so often written, and the art itself had attained to so great a degree of excellence, that there was very little to say about it that would be new; the great drawback being the high prices, which placed the better sorts of majolica and pottery beyond the reach of the public generally, while there was still a vast field for improvement in the pottery of every-day life. The lecturer then went into the subject of the Greek painted vases, distinguishing the different styles and epochs of their manufacture, and drawing attention to the lightness of the material and the beauty of the drawing, especially those of the best period. Mr. Battam's imitations were noticed, and a suggestion put forth that the ware might possibly be advantageously employed for desert services and flower vases. The Roman Samian ware and the celebrated works of Wedgwood were the next subjects touched upon, attention being called to the more harmonious tints of the early specimens as compared with the more modern productions. Mr. Burges next proceeded to give a short history of the celebrated Italian majolica, more especially the productions of Pesaro, Urbino, and Castel Durante, with short notices of the works of Luca della Robbia, Bernard de Pallissy, and of the Henry II. ware. These were compared with the modern productions of Mr. Minton. This was followed by a short notice upon tiles, more especially those commonly known as encaustic, of which the Chertsey ones were pointed out as the best examples of mediæval art applied to the manufacture. Godwin, of Lugwardine, near Newport, in Wales, was designated as the best modern maker of encaustic tiles resembling the ancient ones. The last subject treated on was porcelain, the name being supposed to have been derived from the resemblance of the china to a substance (believed to be mother-o'-pearl) mentioned in mediæval inventories. The new ware was introduced into Europe by the Portuguese, in the beginning of the 16th century, but it was not until the middle of the succeeding one that it was first made at Dresden; other manufactories were then established at Sèvres, in France, and at Bow and Chelsea, in England. The lecturer concluded by drawing attention to the beautiful colours of the Rose du Barri and blue turquoise, as produced by Minton and Daniell, and expressed a wish that means might be found, by the application of printing, to reduce the cost of all these beautiful manufactures. On the

table was a collection of specimens illustrative of the various branches of manufacture referred to by the lecturer. Mr. Wareham lent some specimens of old china; Messrs. Battam lent some Etruscan vases, ancient and modern, and some porcelain, imitating the Limoges enamel. Messrs. Phillips contributed some modern majolica and porcelain; Messrs. Daniell some porcelain from their manufactory, known as that of Rose of Coalport; Messrs. Goode lent some specimens of modern majolica and porcelain, of various kinds, manufactured by the Messrs. Minton; also some ancient majolica from the private collection of Mr. W. J. Goode, and some drawings on porcelain by the latter gentleman, after Holbein and Bartolozzi. To all these contributors the thanks of the Society are due.

ELEVENTH ORDINARY MEETING.

Wednesday, February 24th, 1864; Dr. A. W. Williamson, F.R.S., Professor of Chemistry, University College, London, in the chair.

The following candidates were balloted for and duly elected members of the Society:—

Cameron, Robert M., Canning-house, Edinburgh.
Defries, Daniel N., 5, Russell-place, Fitzroy-square, W.
Grant, Albert, Roseau-house, Addison-road, W.
Huntsman, Henry, 126, New Bond-street, W.
Kempton, Henry Tattersall Knowles, 17, Cavendish-place, W.
Travers, Archibald, 19, St. Swithin's-lane, E.C.
Westmacott, Percy, Whickham, Gateshead-on-Tyne.

The Paper read was—

ON PETROLEUM, ITS ECONOMIC VALUE, AND A VISIT TO THE PETROLEUM WELLS OF CANADA.

By WILLIAM MARCET, M.D., F.R.S.

While travelling through Canada, during the months of August and September of last year, I visited the petroleum wells of that country, and availed myself of the opportunity to obtain all the information I could about them. Shortly after my return, I requested to have the honour of communicating a short account of these observations to the Society of Arts, when it was suggested that I should treat the subject at somewhat greater length. I accordingly entered upon an inquiry into the present state of the petroleum, or rock-oil trade, and its prospects, and I also undertook a series of experiments on the illuminating power of this substance, with a view to endeavour to contribute thereby to our knowledge of its economic value.

Irrespective of my own observations and inquiries, the *Weekly Philadelphia Coal-oil Circular*, containing a digest of all that is published in America on the subject of petroleum, has afforded me an important means of information. My distinguished friend, Professor Lesley, of Philadelphia, has recently issued an elaborate essay on petroleum, to which I shall have an opportunity of referring; and many other of my friends engaged in business in London, have kindly afforded me their assistance on the present occasion.

Petroleum has been known from a very remote period; Herodotus* describes a bitumen spring in Zante, one of the Ionian Islands, which was probably used for embalming. Dioscorides informs us that rock-oil was collected in Sicily, and burnt in lamps at Agrigentum. The famous petroleum springs of Baku, on the shores of the Caspian lake, have been known from the time of Zoroaster. In Italy, the oil wells of Parma and Modena date back nearly two centuries, the year 1640 being assigned to their discovery. The springs of Amiano have long lighted the

streets of Genoa. In France, oil springs have been known from time immemorial at Clermont and Gabian, South of Vesuvius, a spring of petroleum bubbles up through the sea. In the island of Trinidad, in the West Indies, petroleum indulges in strange freaks; it not only exudes from wells and springs in the usual way, but it has formed a lake between two and three miles in circumference, warm, and liquid in the centre, where it is always slowly boiling, but thickening as it recedes from this point, till at the margin it is sufficiently cold and solid for persons to walk upon it at pleasure when the weather is cool; and when the weather is hot they have an opportunity, as stated in the *Philadelphia Coal-oil Circular*, of learning by experience how flies feel in molasses. Masses of bitumen are scattered over the ground in the vicinity of the lake, and stand out amongst the foliage like rocks of brilliant jet.

We are principally interested in the American petroleum, as hardly any other kind has been hitherto consumed in England. Although it was ascertained that this oil was known to the aborigines on the invasion of America, it was not until after 1853 that it came into general use; there was then a well, or pit, on the premises of Messrs. Watson and Co., lumber dealers, in Titusville, on the surface of which from time immemorial oil had been floating; this was collected for medicinal purposes by absorbing it in blankets. Dr. Brewer conceived the idea of using this oil for lubricating and illuminating purposes. This was the beginning of a business which now amounts in value to several millions of dollars per annum. Dr. Brewer induced a company of gentlemen to take an interest in the undertaking, and the Pennsylvania Rock-oil Company was formed in the autumn of 1854, with a nominal capital of 300,000 dols.; this corporation was regarded, however, as a fancy stock concern, and the shares soon declined to a merely nominal value. In the winter of 1854 Professor Silliman analysed the oil, and reported so favourably thereon, that large investments were made in the stock of the Pennsylvania Company; but the enterprise languished for several years, until in 1858 Mr. Bowditch and Col. Drake, who had been sent out to work the property, conceived the idea of digging a well on the lands which had yielded so promising a surface show of oil, and were rewarded by pumping first 400 and afterwards 1000 gallons of oil per day, as stated by Professor Lesley.

Since that time adventurers flocked to Oil Creek. Some were successful, while others, exhausting all their funds, were compelled to relinquish their hopes. One spring was sunk, in 1850, from which flowed, without pumping, about fifty to sixty barrels per day; this was considered marvellous.

In 1861 the first large flowing well was struck, which ran about 1000 barrels per day, but before arrangements could be made to secure this source of wealth, the well caught fire, and twenty-two persons were burnt to death. Shortly after a well was dug on the land of Brewer, Watson, and Co., which yielded the enormous quantity of 2,500 barrels per day. Another, and another, flowing well was struck, until the produce became so large, that the market, in the infancy of the trade, was overstocked. It was estimated that the production in the winter of 1861-2 was 15,000 barrels per day, and the price of the oil declined to ten cents (5d.) per barrel at the wells. The consequence of this was, that the low price favoured the introduction of the oil into domestic use, and has created an export demand which has constantly been increasing. Thousands of wells have been bored in the Oil Creek Valley, Pennsylvania, but it is estimated that not more than 15 per cent. have been productive. One was bored to the depth of 1006 feet (the deepest well of all), but it produced no oil. Boring for oil is, in fact, a lottery; some obtain rich prizes, but more are ruined; and the valley is dotted with dilapidated derricks—the melancholy monuments of departed hopes and ruined fortunes.

In illustration of the uncertainties attending the search

* Book VI., Chap. cxix.

after oil, the following incidents are related in the *Philadelphia Coal-Oil Circular*, from which the above has been extracted:—One well was bored with the usual centrebite, to a considerable depth, without any oil being found; on withdrawing the bit and putting in the rimmer to widen the well, a vein was struck at the side—the bit had just missed the vein—and the well would have been a failure had not the orifice been enlarged. A well was at one time bored which promised to be very productive, flowing a large amount of oil; the owners of the well not being ready to collect it, a plug was driven into the pipe, upon the removal of which, when tanks had been built, the oil had disappeared, and the hopes of the proprietors faded away “like the baseless fabric of a vision.”

The result of an inquiry into the prospects of the petroleum wells, although in no way discouraging, is not so promising as might have been expected. The following is extracted from the *Philadelphia Coal-Oil Circular* for September 21, 1863 :—" It is but natural that a feeling of doubt, on the present supply of petroleum lasting, should exist in the mind of all those engaged in the trade—a short six to eighteen months has, with a few exceptions, been the average life-time of flowing wells; the latter portion of their time of running is also marked by a decrease of at least three-fourths of the original flow; this, and the fact that all the wells struck have shared the same fate, is what tends to impair the confidence of many; notwithstanding this, we can see but little material difference in the amount produced 12 years ago and now; old wells have been abandoned and new ones struck; the result at Oil-creek, so far this season, has been three first-class wells; in the second class may be counted two yielding about 500 barrels a day, and several others approximating to that figure; others have been struck averaging from 75 to 150 barrels per day; in addition to this may be mentioned many new pumping wells, and many of the old abandoned ones that are now pumping or flowing from five to twenty barrels.

"The boring of wells is at present nearly confined to a narrow basin, about 80 rods wide; probably not less than 500 wells have been sunk during the present season in this territory. It is estimated that the total number of wells now down, or in process of being sunk, will average three to an acre. This process of honey-combing the land lets out the subterranean gas, which gradually fails to force up the oil; it also admits water into the wells, effectually stopping or drowning them. In many cases water has flooded good flowing wells, thereby rendering them worthless."

Although this report does not exhibit the Pennsylvanian wells in a condition of increasing prosperity, they keep up their supply, and the writer expresses a confident hope that an improved method of going to work will increase the produce.

Let us now consider the state of the petroleum trade in our own country. Both the total exports of rock-oil from America, and the imports into this country, have increased in a remarkable degree in the year 1863. The following statement respecting petroleum appears in Messrs. Rose, Graham, and Wilson's annual market report for this year.

Actual export from America to all parts (1863).....	27,139,467 gals.
" " (1862)	10,318,658 "
Import into London (1863).....	98,000 barrels "
" " (1862).....	28,335 "
" " Liverpool (1863).....	145,000 "
" " (1862).....	80,000 "
Present stock in London (refined)...	23,164 "
" " (crude).....	3,199 "
" " Liverpool (all kinds)	70,000 "

Average prices of refined in London:—January, 2s. 5d.; February, 1s. 11d.; March, 1s. 6½d.; April, 1s. 7½d.; May, 1s. 10d.; June, 1s. 11d.; July, 2s. 2½d.; August,

2s. 3½d.; September, 2s. 6½d.; October, 2s. 4¼d.; November, 1s. 11½d.; December, 1s. 11d.

In addition to the above these gentlemen observe that the idea generally entertained of petroleum ultimately becoming an important article of commerce, has been more than realized during the past year. Not only has the consumptive demand steadily increased to the extent of its now being greater than that of any other burning commodity, but the great fluctuations in prices have laid bare a field for speculation which has been eagerly embraced.

A firm of London brokers informed me that during the end of November and part of December last they sold no less than £100,000 worth of petroleum, for consumption and speculation.

Since last month a new supply of rock-oil has found its way to our market, as we are informed, in the *Times* of the 6th January, that 280 tons of this substance had just arrived from Wallachia, on account of the Earth-oil Import Company, who had contracts extending over this year for the delivery of about 20,000 tons, of a quality guaranteed to be at least equal to that of Pennsylvania.

Again, a Wallachia Petroleum Company has just been advertised, who have entered into arrangements with the Earth-oil Import Company for the purchase of their plant. Thus it is, that even should the American supply of rock-oil diminish, our trade will probably in no way suffer from it.

Petroleum, when burnt in one of the lamps, which I believe to have been originally patented by Young, gives out a fine light with a tinge of yellow in it, and is not nearly so dazzling as gas. The products of the combustion of the oil have no perceptible smell, indeed, they are less deleterious than those of any other illuminating material. Petroleum, as stated by Dr. Frankland in a lecture at the Royal Institution, gives off less carbonic acid than other lighting bodies, and much less than coal-gas; the amount of light emitted varies in great measure according to the surface of the flame; if the wick has carefully been trimmed, the flame spreads out much like that from a fish-tail gas-burner, but as the oil burns off the flame becomes smaller and duller, giving out less light, till finally the wick begins to char, and the light emitted is much diminished.

With the view of undertaking some experiments on the lighting power of petroleum, I had a photometer made by Mr. Sugg.

The instrument consists of a large box, divided by a screen into two compartments. There is a moveable stage in each compartment, on which the lights are placed. The screen consists partly of a disk of paper, plain in the centre, with an oiled zone round it. When both lights shine with an equal power, on both sides of the disk, the centre becomes invisible, but if the lights should be of unequal strength the centre is clearly seen. By moving the stages, both sides of the disk can be equally illuminated, and the relative distance between the lights and the screen, will show their relative illuminating power; bearing in mind that the intensity of light varies with the square of their distances. Two mirrors are placed at a certain angle behind the disk, enabling the observer to view both sides of it at once, and judge with great accuracy of the relative power of the lights under trial.

It must not be supposed that I claim the merit of being the first to inquire into the illuminating power of petroleum; a very interesting and elaborate paper on this subject, by Messrs. James Booth and Thomas Garret, will be found in the *Philadelphia Coal-oil Circular* of the 13th April, 1863; and another by Mr. Charles Wetherell, is published in the same journal of the 3rd January, 1863. Dr. Frankland has also made experiments on this subject, and his results were communicated last year to the Royal Institution.

The petroleum and lamps I used, were procured from the Metropolitan Light Company, in the Strand. A lamp

was provided, with a flat wick six-eighths of an inch broad; it was filled with petroleum, and lighted. I ascertained the light to be equal to 6.5 sperm candles; one half of the oil was now removed from the lamp and the lighting power of the flame again tested, when it was found equal to 6.3 sperm candles; finally, the remaining bulk of oil was again reduced to one half, when the lighting power of the flame was diminished to four candles, or only about two-thirds of that it possessed when the lamp was full. With this small quantity of oil the wick rapidly charred, and the flame assumed an irregular shape.

From this experiment it may be concluded, that a petroleum lamp must not be much less than half full to give out its best light.

The shape and surface of the flame was also found to affect materially the amount of light emitted, the best shape being that expanding like a fan, and flat at the top; when tapering into a point at the top, the light was not nearly so good. The shape of the flame depends on the trimming of the wick, the best mode of trimming being to cut the wick straight across, and bevel the edges laterally, so as to give the top of the wick a slightly convex shape laterally; with a wick an inch broad, the corners may be just cut off, to prevent the risk of the lamp chimney breaking; a little practice will quickly enable anybody to prepare the lamp in the proper way.

The light of different lamps varies according to the size of the wicks. I am inclined to think that lamps with wicks six-eighths of an inch broad will be mostly used, as the light emitted is a good one, and fit for all practical purposes; when properly trimmed, with a full supply of oil of an average quality, and the wick turned up as high as possible without smoking, these lamps will give a light equal to six and a-half sperm candles, with a flame one and five-eighths of an inch broad near the top, and as high as it is broad.

If, instead of placing the broad surface of the flame opposite the disk of the photometer, the narrow, or side surface, be turned towards it, the light emitted is found to be only equal to five candles instead of six and a-half.

I next examined the light of a smaller lamp with a wick a little over half an inch in breadth; the light given out under the same conditions, as in the former experiments, was equal to 4.8 sperm candles; this is a good useful light, and for the sake of strict economy, is preferable to the other,—it is, at all events, infinitely better than candles.

Let us now proceed to compare the light given by a petroleum lamp, with a wick six eighths of an inch broad, and that given by tallow candles, composites, sperm candles, and oil.

The results have been arranged in the form of the following table, on which I shall make a few remarks:—

	Petroleum.	Gas.	Tallow candles.	Composites.	Sperm candles.	Colza Oil.	Sperm Oil.
Light emitted ...	I.	1 to 1.3	10	6.3	6.5	0.61	0.55
Weight burnt in 3 hours 18 minutes	1,386 grains.	12.7 cubic ft.	408	5.50	4.80	29.01	3.250
Price of material burnt in 3 hours 18 minutes	1d.	½d.	½d.	1d.	1½d.	2½d.	5d.

From six experiments, where the amount of petroleum burnt varied from 393 grains to 466 grains per hour, the average quantity of the oil consumed was 420 grains, the price of which, at 3s. 8d. a gallon, would be three-tenths of a penny, and consequently an amount of petroleum worth only one penny will burn for three hours and eighteen minutes; now two tallow candles, burning for three hours and eighteen minutes, will cost about one penny, and, as according to my experiments, petroleum gives about ten times as much light as a tallow candle, it will follow, that the expense of burning petroleum will be the same as that

of burning two tallow candles, and there will be no less than five times as much light obtained from the oil as from the two candles.

In addition to the above advantage of petroleum over tallow, I may observe, that from the year 1860, the arrivals of tallow into London have diminished every year: the deliveries have also fallen off since 1861.

This scarcity of tallow in the market must necessarily enhance the importance of petroleum. I am indebted to a friend for the accompanying table, which shows very clearly the state of the tallow trade since the year 1859:—

PARTICULARS OF TALLOW (IN LONDON).

Stock on the 1st June.

	Tons.
1859	12,081
1860	27,094
1861	65,555
1862	38,304
1863	37,812

Arrivals.—1st June to 31st May.

1859-60	94,625
1860-61	117,982
1861-62	100,122
1862-63	78,579
1863-64, to 13th February	799,87

Deliveries.—1st June to 31st May.

1859-60	79,612
1860-61	79,524
1861-62	118,573
1862-63	79,071
1863-64, to 13th February	54,968

Messrs. Rose, Graham, and Wilson, in their annual market report for the present year, inform us that the consumption of tallow has been much interfered with, through immense quantities of lard being imported from America, (which, but for the war, would have gone to the Slave States), and the substitution of petroleum in the place of common candles.

In comparing the expense of burning petroleum with that of consuming coal-gas, by measuring the amount of gas consumed, with a very accurate gas meter, it will be found that the quantity of gas burnt, by a good fish-tail burner, in three hours and 18 minutes is 12.7 cubic feet, which, at 4s. 6d. per thousand feet, will cost six-tenths of one penny, or, in round numbers, a trifle over one half-penny.

With respect to the light given out, that of gas supplied as above is generally a little less powerful than that of petroleum, but for all practical purposes both lights may be considered equal; consequently gas in London, at 4s. 6d. per 1,000 cubic feet, is half the price of petroleum, but the oil presents many advantages over gas, which will make up, in a great measure, for the extra expense, as, for instance, the portability of a lamp, the pleasant subdued light of petroleum, instead of the dazzling brightness of gas, and also the fact shown by Dr. Frankland, that there is less heat given out by petroleum than by gas, and less products of combustion injurious to health. Then, in many small towns gas is very dear, and houses are but indifferently supplied with it; in other places, such as villages, country houses, there may be no gas at all, and in these cases rock-oil becomes an invaluable boon.

Where gas is very cheap, as in coal districts and manufacturing towns, it is probable that there will be but little petroleum consumed.

The following is a list of prices of gas for 1000 cubic feet in several towns in the United Kingdom. In those in which this commodity is dearest the oil will be most welcome, and *vice versa*:—

	s.	d.		s.	d.
Walton-on-Thames	7	0	Hereford	4	6
Sutton	7	0	Loughton	4	3
Berwick	6	8	Stoke-upon-Trent ...	4	3
Buckingham	6	6	Leicester	4	2
Weymouth.....	5	6	Hull	4	0
Aberdeen	5	5	Oxford	4	0
Gloucester	5	0	Sunderland	4	0
Limerick	5	0	Belfast	3	9
Birkenhead.....	5	0	Birmingham	3	9
Whitby	5	0	Wakefield	3	9
Stafford	5	0	Bristol	3	9
Scarborough	5	0	Lincoln	3	9
Peterborough.....	5	0	Durham	3	9
Dublin	4	9	Manchester	3	6
Balham	4	9	Leeds	3	6
Falmouth	4	9	York	3	6
Preston	4	9	Derby	3	5
Edinburgh	4	7	Liverpool	3	5
Glasgow	4	7	Carlisle	3	4
Rugby	4	7	Newcastle (Tyne) ...	3	4
London	4	6	Bradford.....	3	4
Chester	4	6	Nottingham	3	4
Cambridge.....	4	6	Cardiff	3	3
Cheltenham	4	6	Walsall	2	6
Worcester	4	6			

I have but a few remarks to offer on the expense of burning composites, sperm candles, sperm oil, and colza oil, compared with that of petroleum. One pennyworth of composites, while burning, will last as long as one pennyworth of petroleum, but the petroleum will give out 6·3 times as much light. As for sperm candles, the weight burnt in 3 hours 18 minutes will cost 1½d., or 1·3rd of a penny more than the petroleum, and the latter will give out 6·5 times as much light, consequently, there will be a considerable saving by using petroleum instead of sperm candles; the economy will be still greater if petroleum be consumed in the place of sperm oil, as the amount of this agent burnt by a very good moderator lamp, in 3 hours 18 minutes, will cost 5d. (at the rate of 10s. a gallon), or five times more than petroleum, but then the light emitted from sperm oil will equal that of twelve sperm candles; a moderator lamp, with sperm oil, will therefore burn as brightly as two petroleum lamps, with a wick 6·8ths of an inch in breadth.

There are petroleum lamps made provided with wicks over an inch broad, and giving a light nearly, if not as fine, as that of sperm oil, and the use of these will cost much less than 5d. for 3 hours 18 minutes.*

The objections to the use of petroleum are, its smell, the danger of the oil taking fire under certain circumstances, and being explosive where its vapours are mixed with air, and also its effects on the health of those engaged in the refining and wholesale trade of the substance. Petroleum, as extracted from the earth, certainly has a very unpleasant smell, but it is never used unless previously refined, when its odour is thereby greatly diminished. A petroleum lamp burning in a room does not, as far as my experience goes, give any smell, although a number of lamps, kept filled and ready for use in American cars and steam-boats, certainly do emit a slight but unpleasant odour. It is, however, principally when the lamp has just been put out, or whilst it is being trimmed, or filled afresh, that the smell is perceived; this odour is slightly unpleasant, but not unwholesome, except perhaps in the case of individuals engaged in the wholesale trade of the oil, as, for example, sailors on board ships laden with it, and workmen in refineries.

The danger of using petroleum from its being an inflammable, and, under certain circumstances an explosive sub-

* I have also examined the illuminating power of colza oil compared with that of petroleum; the light emitted is not quite twice as strong as that of petroleum, and its price is a little more than double that of petroleum. Colza oil is, in every respect, much cheaper than sperm oil.

stance, must not be exaggerated. It should be remembered that when coal-gas was first introduced most serious objections to its use were entertained from its explosive power, but this opposition has not prevented gas from being, at present, the most extensive means of obtaining artificial light.

Most deplorable accidents have certainly happened from the use of petroleum, and it is of the highest importance that everybody who employs this substance should do so with due care. If a lamp containing properly refined petroleum in a receiver made of earthenware or any other non-conducting substance, be allowed to burn undisturbed, I cannot think there is any fear of an explosion; indeed I am at a loss to understand by what means the oil can become sufficiently heated within the lamp to give out inflammable vapour. It is only with petroleum of bad quality that such accidents may occur; I mean when the oil gives out inflammable vapours below the temperature of 128° Fahr. To guard against this cause of accident I should advise people to test their petroleum before burning it. Mr. Young has recommended lately, in the *Times*, a method to effect this purpose, which is applicable to both coal-oil and petroleum. His plan has the advantage of affording the required information without the use of a thermometer.

The *Daily News* of the 21st inst. states, that at a meeting of the Association of the Medical Officers of Health, held on the 19th inst., Mr. Tegetmeier exhibited a very easy and practical mode of detecting dangerous oils. Two tea-cupfuls of boiling water and one of cold water were mixed together in a small basin; a cupful of the water was then taken, and a tea-spoonful of the oil to be tested poured on its surface; in a few seconds a light was applied to the oil. The dangerous oils, those capable of igniting below 120°, immediately took fire, whereas it was shown to be impossible to ignite those that were of a safe and non-explosive character.

By increasing the heat of the water, and testing the oil at every 10°, the temperature at which it will take fire is easily ascertained. It should be remembered, however, that the oil evaporates very quickly, so that a small quantity of the substance, say a tea-spoonful, should be added, now and then, to the portion left in the water; if the oil takes fire at a temperature below 128° it should be rejected.

The most frequent cause of accident is owing to the upsetting of a lamp, when the oil flowing out becomes kindled; great care should therefore be taken to place a petroleum lamp in some spot where it is not likely to be upset. I would, for instance, object most decidedly to the use of petroleum on board ships; the confined state of a cabin making any article therein, liable to be thrown down by an accidental back stroke of the hand, or some similar cause; but a still more serious objection applies to the pitching and rolling of the vessel at sea, which is likely to capsize any article that is not a fixture.

To avoid, as far as possible, accidents from the upsetting of lamps, where petroleum or hydro-carbons are burnt, I would suggest that lamp-makers should never turn out a lamp as fit for use unless the foot, or the part under the oil receiver, on which the lamp stands, be a good deal wider than it is generally made at present, and unless the weight of the lower part of the lamp be increased, by the addition of lead or some such metal. Many of the cheap glass lamps, used at present somewhat extensively, for burning such substances as petroleum, are more or less top heavy, and a trifling additional expense would make them much steadier and much safer. Supposing the case of a lamp upsetting and the oil taking fire, prompt measures will easily put out the flame, if the person on the spot does not lose his or her presence of mind; after placing the lamp upright, by throwing a cloth over the oil, or covering it with anything flat, to keep off contact with the air, the object will be speedily attained.

In order to obviate every risk of accident, as well as the smell, on board ships engaged in the petroleum trade,

a new plan has been adopted and carried out, on board the ship *Jane*, the property of the Liverpool and Ramsay Oil Refining and Chemical Works. The oil is stored in this ship in iron tanks, hermetically closed; the whole operation of transferring the oil from the vessel to the premises of the company has been effected without causing any nuisance whatever, as no smell of the oil could be perceived in the neighbourhood of either the vessel or the works.

My information as to the effects of petroleum on the health of those engaged in its wholesale trade is not sufficiently extensive and positive to allow me to enter into this part of the subject. I shall presently allude to the enormous quantity of sulphurous acid gas given out during the process of refining, which must affect more or less the lungs of those engaged in this business.

I have not attempted, on the present occasion, to establish the relative merits of refined petroleum and coal or paraffin oil, as more time should be devoted to this subject, to do it justice, than I could possibly command.

A VISIT TO THE PETROLEUM WELLS OF CANADA, IN SEPTEMBER, 1863.

The rock oil or petroleum wells which I visited in Canada, are situated near the southern extremity of Lake Huron, at a spot called Black Creek, in the district of Emskillen. The town nearest the wells is that of Sarnia, built in a very picturesque bay of Lake Huron, and opposite Port Huron, in the state of Michigan. I stopped at Sarnia, with the express purpose of going over to Black Creek. A branch of the Great Western Railway of Canada connects the town of Sarnia with the village of Wyoming, sixteen miles distant, in a due east direction. From thence there is a high road proceeding nearly due south, by which Black Creek may be reached in a coach in two hours and a half, the distance being twelve miles. The state of this road, cut out through a dense forest, is still most primitive, and much difficulty is experienced in conveying in drays the barrels of oil to Wyoming. Suddenly a gap in the forest makes its appearance, the road turns to the left, skirting a pool of dark and stagnant water, and the adjacent village of Black Creek comes into sight.

The place has the appearance of being a rough clearing in a forest, crossed by a high road, on both sides of which are scattered a number of small wooden houses, containing a population of about 1,500 souls. In the intervening space between the houses and the wood, turf and stumps of trees may be seen; the Creek lies in a hollow, close to the village on its north side; its banks are now mostly barren of vegetable life, and here and there are felled trunks of trees, blackened as if by the action of fire, but on a closer inspection they are found to be covered by a black gummy coating of tar. The soil about these banks is black with the same material, and on the stagnant water of the pool floats a layer of a black oily substance, emitting a smell of naphtha, and on a bright day exhibiting a remarkable display of colours. Several rock-oil refineries have been erected on the banks of the Creek, into which they discharge the impurities of the crude oil.

The existence of liquid bitumen in the limestone of Western Canada was pointed out as long ago as 1844 by Mr. Murray,* and in the year 1850, or shortly after, this gentleman described a considerable deposit of solid bitumen, or mineral tar in Canada, extending over about half an acre; it was not, however, till 1857, that the distillation of this substance was undertaken, and I conclude that the account of the discovery of the petroleum springs which I heard related at Black Creek refers to that period.

This event occurred quite accidentally, as follows:—For some time previously a mass of semi-solid tar-like substance had been found in the forest, which on being

refined yielded a small quantity of oil; it had been thought worth while to establish a refinery near this spot, and with the view of obtaining water for the steam-engine, a well was sunk, when suddenly, instead of water, a stream of petroleum burst forth. The second spring was discovered about a mile further off, on a farm, where I understood pigs had been burrowing. Some oil had oozed out of the ground, and a well being dug there, it yielded a full supply of this valuable substance. Since then no less than from 200 to 300 wells have been sunk upon an area of about two miles in length by one mile in breadth. At first oil flowed freely from these openings, but the supply gradually diminished and then ceased being yielded spontaneously, when it was found necessary to pump up the fluid. For about a year none of the wells have yielded spontaneously flowing oil. A number of wells have been recently abandoned, as not worth working, so that at present there are not more than about 100 wells from which petroleum is obtained. I walked into the forest, and presently came to a steam engine, placed under a shed, and used in boring a well. I was told that the depth then arrived at was 347 feet, and, so far, little or no oil had been found. When a well is about to be sunk, a convenient place is chosen, but there are no indications whatever to be adopted as a guide for the selection of the spot most likely to yield a good supply of petroleum. A shaft is first sunk through a layer of clay from 30 to 70 feet thick, then a layer of limestone rock is reached, and the boring effected by means of a steam drilling machine. The diameter of the pipe is about 3½ in.; several intelligent well-owners, whom I heard discussing the rate at which the boring operation is carried on, concurred in the opinion that from 1½ to 2½ feet was the depth attained every 24 hours. I was told, by a competent judge, that the sinking of a well costs about three dollars per foot, and that there is no certainty as to the result. The operation may be a complete failure, or prove a very lucrative one; but the probability of success is much less now than formerly. On one occasion it took nine months to drill through 550 feet of rock, at an enormous expense, and no oil was found. The deepest well which is now being worked attains a depth of 250 feet in the rock. Most of them are from 150 to 200 feet in the rock. The pumps used to raise the oil out of the wells are generally worked by steam-power; but sometimes the operation is carried on by means of horses, and occasionally by hand. The object of pumping, besides that of raising the oil, is to remove the water which continually accumulates in the well. Where a steam engine is continually kept at work, oil and water are raised together; but if the operation be discontinued for any length of time, it will be found necessary to pump out water alone, before any oil can be extracted.

In my ramble through the forest I saw two men engaged in pumping a well by hand; they told me that after pumping up water for a whole day, about a barrel of oil (or 40 gallons) rose to the surface during the night, this they ladled out the following morning, and then proceeded again to pump out the water. The men informed me of a very ingenious method which they adopted for measuring the thickness of the layer of oil in the well; for this purpose they let down into the oil an empty bottle, fastened to a string with the opening turned upwards. The depth to which it was necessary to lower the bottle in order to fill it with water indicated the thickness of the oil stratum. It will be understood that when the bottle was immersed into the petroleum it became filled with this substance, but as soon as it reached a spot below the oil, the water of the well, on account of its greater weight, displacing the oil from the bottle filled it at once. I visited several wells where oil and water were pumped out together, by means of steam power; a black stream issued from the spout, the depth of colour of the fluid continually changing according to the proportion of the oil present; the liquid was received into a large wooden tank, first falling on a splashing board,

**Philadelphia Coal Oil Circular*, 2nd Sept., 1862.

which afforded better means of judging of the colour of the stream, and thereby ascertaining roughly the quality of the oil; only 1 per cent. of oil gave the stream a very dark colour. I myself collected a specimen of the fluid in a bottle by placing it under a pump spout while water and oil were being raised out of the well. The tank was generally about 10 feet diameter by 7 feet deep; its upper part was occupied by a layer of crude oil, which, being much lighter than water, had quickly risen to the surface. This crude oil presented an intensely black colour and a thickish consistency. I was informed that when it has reached a certain height in the reservoir it is let out by a side pipe, by which it passes into a smaller cask, which contains nothing but the oil; by opening a tap at the lower part of the tank the water is allowed to escape. This simple method effectually separates, without trouble, the petroleum from the water with which it was originally mixed. The crude material is let out from the smaller cask into barrels, each containing 40 gallons. The pump I have sketched raised the oil from a well 246 feet deep from the surface, 196 feet of which are in the rock. I observed two wells close to each other, and pumped out by one steam-engine; they were both sunk to a depth of 225 feet through the rock, and 270 feet from the surface. I was given to understand that the pumpshafts opened at about 30 feet from the bottom of the wells, but there is no rule as to the distance intervening between the end of the pump pipe and the bottom of the well; this varies in different wells from ten to thirty feet. My attention was directed to the escape of gas occurring at the mouths of the pipes through which the oil was pumped out of the two wells I was observing. This gas imparted to light a peculiar oscillation, which revealed its presence. No positive information can be obtained as to the distribution of the oil in the bowels of the earth; it is invariably found, at Black Creek, in limestone rock; and we may surmise that in order to yield oil a well must strike one or more fissures through which this fluid is slowly flowing. The petroleum appears to be washed out of the fissures by water, but I am not aware of any evidence showing that water does not enter the well through other channels. The pressure exerted on the openings into the oil-bearing fissures by the column of water which accumulates in the well is a great obstacle to the flow of oil; and on this account it is important to keep the pumping-engines at work day and night. If the operation be discontinued, even for a few hours, it will be necessary to pump up water for a still longer time before any oil can be obtained.

I have previously stated that when the springs were first discovered a large quantity of rock-oil was discharged spontaneously. This phenomenon appeared due to the pressure exerted by a certain quantity of gas confined in a cavity between the surface of the fluid and the rock, the oil being thereby pressed out with much force through the fissures existing in the rocky reservoir; from the remarkable circumstance that the wells all ceased flowing spontaneously at about the same period, it does not appear improbable that the various springs issued from one original mass of the substance in question; the oil ceased flowing apparently because the gaseous pressure in the oil-trough became relieved from the gas escaping through the wells.

There is much uncertainty as to the origin of petroleum. Professor Lesley* observes, "that oil is not found in immediate contact with coal beds made of land or fresh water-plants; but, on the other hand, coal oil regions are geographically connected with coal bed regions whether of Devonian, carboniferous, oolitic or tertiary age." Another statement of Professor Lesley appears to show that petroleum may also have an animal origin, for he observes, "The coniferous limestone next above the Niagara has the cells of its fossil corals filled with

petroleum, the remains of the gelatinous coral animals which inhabited them."

The crude oil is conveyed at once to the refineries, many of these establishments being close to the wells at Black Creek. The object of the operation of refining is to separate the oil from the tar, and to remove from it certain volatile constituents, among which is a compound, very combustible and explosive at comparatively low temperatures. This oil is also discoloured, and in a great measure deodorized before leaving the refinery. The usual mode of proceeding is to commence by submitting the crude oil to distillation; the first portion of the fluid which distils over contains the dangerous compound and is set aside; the residue is pumped up into a large vat, where by means of steam-power it is briskly stirred with sulphuric acid and water. During this operation a large quantity of sulphurous acid is formed, and the fluid assumes a white milky appearance. The amount of sulphurous acid evolved is so great that none but men accustomed to the work can remain in the room where the operation is being carried on. This I had an opportunity of ascertaining to my own discomfort; and I feel assured that this part of the business of refining rock-oil must be very unhealthy. After a certain time the stirring is discontinued, when the liquid divides into two layers, a lower layer, exhibiting the appearance of a white emulsion, and a higher one, consisting of pure oil. The lower portion is now drawn off by opening a tap at the bottom of the vat; more water is added to the oil from above, and the stirring rod is again set in motion; this operation is repeated several times, until the whole of the sulphuric acid and impurities have been washed out of the petroleum. It is now nearly colourless, and its smell becomes much less perceptible. I witnessed the various processes carried on in petroleum refineries at Black Creek, but never saw any kind of alkali used. I believe, however, the final treatment with some alkali is frequently if not always adopted.

Before barrelling, the oil is usually tested, to make sure that the temperature at which it takes fire is sufficiently high. Mr. Price (who I believe was formerly chemist to the now dissolved Oil Well Company of Canada) kindly supplied me with much interesting information on the refining of crude petroleum, and presented me with a specimen of refined oil, which, he told me, could be heated to 180° without taking fire. I sincerely regret having just heard that this able and obliging chemist died at Black Creek in November last.

The supply of rock-oil in Canada has considerably decreased of late. While at one time one spring yielded no less than about 2,000 barrels in 24 hours, in September last the whole quantity of petroleum extracted weekly from the Black Creek wells did not exceed from 700 to 800 barrels.

I have attempted, gentlemen, in this communication, to show you the present condition and prospects of the petroleum trade. I have directed your attention to the economic value of rock-oil; and my description of the Canadian wells may have given you an idea of the aspect and mode of working of all other petroleum wells. I must apologise for bringing forward so little new matter, but I am glad to have had this opportunity of introducing to your notice so valuable a substance as petroleum.

DISCUSSION.

The CHAIRMAN said the meeting must have been deeply interested by Dr. Marcet's very lucid account of the method of obtaining these valuable oils, as well as by the results of his experiments respecting their value for illuminating purposes. There were several other applications of these oils which, no doubt, Dr. Marcet's time had not enabled him to enter into. It was a matter of great wonder that such exceedingly useful materials as these should have remained unnoticed for so long a period of time, for they already represented a considerable amount of wealth; and, if continued supplies were ob-

* "Coal Oil," by T. P. Lesley, Professor of Mining, University of Pennsylvania.

tained, would form an important article of commerce, especially when they considered the great falling off which had of late taken place in the supplies to this country of animal fats, from the whale fisheries and other sources. It was not uninteresting to notice that in this, as in other cases, men only found what they sought for, for although these oil-springs were known to exist, they were only turned to account when a necessity arose for discovering new sources of supply of materials for illumination. Oils of this character had been manufactured by Mr. Young and others in great quantities before the notice of the public was attracted to these oil springs; and being thus made aware of the immense value of these products, men came to direct their attention to their importation into this country. It was to be lamented that the supply of this oil was so intermittent, which would seem to point to the artificial preparation of paraffin oils as a more permanent source of supply. He would now invite discussion on Dr. Marcet's paper.

Mr. TEGETMEIER remarked that with regard to the use of these oils for lighting purposes, he was happy to see that the standard of safety was placed by Dr. Marcet as high as 128° . In the discussion which had recently taken place on the subject in the newspapers it had been asserted that this might with safety be brought down as low as 100° , but he regarded that as a mistake. He had with him a sample of oil that had caused a dangerous accident at Bethnal-green, when an explosion of the oil took place inside a lamp merely owing to a person attempting to extinguish it by blowing it out. The point of temporary ignition of that oil was 112° , and of permanent ignition 114° , and notwithstanding that fact, persons were not wanting who asserted that 100° was a sufficient standard of safety. He had also brought with him a sample of the oil which had caused the loss of three lives in Yorkshire, and the inflaming point of that oil was as nearly as possible 100° . If, however, oils of a sufficiently high standard were employed, the danger was inconsiderable, for in the report by Capt. Shaw, for 1862, upon the fires in the metropolis, 124 fires were attributed to gas, and only two to mineral oils of all descriptions—petroleum and paraffin. Samples of these oils were, however, frequently met with which would inflame at a point below 32° , the freezing point of water. Some might say these were not oils, but spirits; they were, however, unquestionably hydro-carbons, and were used for burning. For instance, he held in his hand a specimen of the oil used to light the *Warrior*, and this would ignite at ordinary temperatures, and if a light were even brought near to it, it would inflame without actual contact. [This was shown by experiment.] He thought it a matter of grave importance that millions of national property and thousands of valuable lives should be thus imperilled. The mode in which it was used on board this ship was this:—Atmospheric air was driven through reservoirs of it, and the vapour thus produced was distributed through pipes, and burnt with ordinary burners, like gas, the absurd title of ozone-gas being given to it. It was, he said, impossible to overrate the danger of that commodity; gunpowder was safe in comparison with it, because a light must be placed in contact with gunpowder to cause it to explode, whereas this vapour was so subtle that it would, in fact, run to the flame. He thought it was impossible to overrate the extreme danger of such a method of lighting on board ships, and the importance of the subject was his apology for having brought it before the meeting.

Dr. BACHHOFFEN said the views of the gentleman who had just addressed the meeting appeared to be opposed to those enunciated by Dr. Marcet, inasmuch as it was urged in the paper that petroleum oils could, with ordinary care, be used with perfect safety. The vapour used on board the *Warrior* in the manner described, was neither more nor less than Mansfield's patent, who unfortunately lost his life in experimenting on these substances. His method of driving atmospheric air through a highly volatile hydro-carbon, was a very different thing from burning that liquid in ordinary lamps; and it was used

under very different conditions to being stored aboard the ship in bottles or other receptacles. At the same time he was not prepared to say it was a wise thing to carry so dangerous a commodity as this had been shown to be on board of one of Her Majesty's ships. Upon the subject of petroleum generally, he would remark it was merely another form of the well-known camphine. But Dr. Marcet had stated two or three facts which somewhat astonished him; one was—that petroleum was less deleterious in combustion than any known combustible compound used for lighting—also, that it gave off less heat. He hardly knew by what standard those two qualities were to be judged. They knew that the illuminating power of any substance depended upon the amount of carbon consumed in the flame, and therefore it struck him as singular that the petroleum oils, which were so rich in carbon, should have less heating powers than other oils. There was one point with regard to the use of rock-oil to which allusion had not been made—that was its employment, under certain conditions, as a substitute for vegetable turpentine. He believed that substitution was carried on to a considerable extent, but he also believed that practical painters and builders always found that paint prepared with it was subject to tackiness and never presented the dry surface which was obtained by the use of the ordinary vegetable turpentine. Dr. Marcet had stated that there was less danger in the use of petroleum than coal-gas. The latter was certainly a very explosive commodity, but with the exercise of due precaution he did not see much difference between the one and the other, and he apprehended the large number of casualties arising from gas were attributable to the fact of its being so extensively used, whilst lighting by petroleum was very exceptional. He believed the majority of accidents with petroleum oils arose from the careless practice of trimming the lamps while burning. The test of these oils had been described as a very simple one, only requiring two cups of water, hot and cold; but while admitting the simplicity of this, he questioned whether one person in a thousand would take the trouble to apply that test each time he got in a stock of oil; and until the sale of this article was so regulated that the persons who used it were perfectly safe from danger, he thought it was not to be recommended for general use in private houses.

Mr. MADDEN took exception to the statement of Dr. Marcet in attributing the invention of the lamp used for burning these oils to Mr. Young. It was, he said, originally the invention of Wagenmann, a German. At the expiration of the three years' protection of the patent it was not renewed, and it was then that Mr. Young took it up and introduced it extensively. The average lighting point of this oil would not be higher than 114° or 115° , and in some cases 125° : at 180° he thought the illuminating power would be very small indeed. He had used petroleum since its introduction, from having seen it employed in Germany, where it was first introduced. He believed with ordinary care it might be used with as much immunity from danger as colza or any other oil.

Mr. B. H. PAUL, having expressed his thanks to Dr. Marcet for his able *résumé* of the known facts with regard to the sources of petroleum, and the purposes to which it had been applied, remarked that no mention had been made of one of the most important instances of the introduction of petroleum into this country—viz., the petroleum of Rangoon, a preparation from which was first used under the name of Belmontine, which was perhaps the best material ever produced for illumination, when its safety and freedom from pernicious properties in combustion were considered. Having himself taken some part in the newspaper discussion referred to by Mr. Tegetmeier, he would say a few words in reply to what had been stated by that gentleman this evening. It was always desirable in the case of a new material like petroleum, where the opinions of scientific men could be of use in guiding the public, that such opinions should be fairly and freely expressed: and that where warning was necessary it

should be as freely given: but at the same time the position of scientific men ought not to be taken advantage of to excite a fear in the public mind for which there was no foundation. For some reason, which he was at a loss to understand, it had been put forward, and to a great extent recognised—more, he believed, from ignorance of the real facts than any thing else—that the characteristic of safety of these materials was that they should not burn at a temperature below 130°. He had no hesitation in saying that was an indication which had no kind of value whatever; and as a proof of that he would state he had been in the habit of burning in his house—not oil—but a spirit made from petroleum, which would ignite at the freezing point of water. He had burnt that spirit in a lamp, in a room the temperature of which was from 65° to 70°, and he burnt the lamp the whole evening without any tendency to accident.

Dr. BACHHOFFNER inquired what was the boiling point of that liquid.

Mr. PAUL replied 70° Fahr., and the igniting point was 32° Fahr. It was an extremely volatile spirit prepared from petroleum. Having enumerated some of the accidents which had occurred in the use of paraffin and other oils, he remarked that the conclusion he had arrived at was, that the danger did not consist in the material itself, but in the folly of those who used it. With reference to the strong point which had been raised by Mr. Tegetmeier as to the employment of so extremely volatile a material for lighting the *Warrior*, he would remark that the extreme volatility of the material was the greatest security against risk in its use, and against the possibility of its explosion.

Mr. E. V. GARDNER said he should be glad to know whether, in the instances of accidents alluded to, the lamps were made of metal or not? because he had found from experiments that petroleum could not be used in metallic lamps without risk. From the conductivity of the metal the lamp became so hot that gas was generated, and there was danger of explosion; but he had never heard of any accident occurring where due caution was used, and where the lamp was made of a non-conducting material. He had experimented very largely with these light oils or spirits; he saw no objection to their being called spirits. Spirits of wine and ether were not so very far removed from this species of petroleum, but they differed in one important characteristic, viz., that it was almost impossible to get an explosion by mixing the vapour of petroleum with atmospheric air, whilst with ether or spirits of wine this could easily be done. The fact of its being possible to burn the vapour of these oils mixed with atmospheric air, using the burner employed by Mansfield, which had nothing about it approaching the safety principle of the Davy lamp, was evidence of non-liability to explosion. Camphine lamps had been in use for a long time, but they did not hear much about the danger of them, and camphine in itself was very much more dangerous than petroleum, and its igniting point was lower than that of most paraffins. He believed most of the accidents that had occurred were in a great measure owing to the want of care and presence of mind of those concerned. He did not believe there was more risk with these light oils than with any other mode of illumination ordinarily employed. Another fact had not been noticed. Some of these paraffin compounds had a peculiar way of creeping, by capillary attraction, out of the lamp and down the sides of it, and drops of oil were found trickling on the outside of the lamp. That oil might become ignited, and, if not soon extinguished, it would so heat the lamp as to cause explosion. He was quite certain paraffin could be prepared without the slightest smell, and without danger as to its igniting point; at the same time, if these oils were improperly distilled, they always contained within them an element of danger.

Mr. G. F. WILSON, F.R.S., said, as Mr. Young had been denuded of the honour of the invention of the paraffin lamp, it would not be fair to deprive that gentleman

of the credit to which he was entitled of having been the first to introduce mineral oils for lighting purposes. Mr. Paul had alluded to the Belmontine oil, which was the result of Mr. Warren De la Rue's chemical investigation of the Rangoon petroleum; though those experiments had been known for a long time, the oil which was the practical result, was not introduced into commerce till after Mr. Young's paraffin oil had been brought out. With regard to the point brought forward this evening by Mr. Tegetmeier, as to the dangerous character of the material used for lighting the *Warrior*, he (Mr. Wilson) was well acquainted with that very volatile liquid; and, at first sight, it would appear to be a somewhat dangerous element to carry on board ship. It had, however, been stated that the liquid was so secured that it could not come into contact with flame; at the same time, it might occur to many present that a valuable Government ship was hardly the proper place in which to try delicate lighting experiments, which, to say the least, this appeared to be. With regard to what Dr. Marcet had stated, as to the economic value of petroleum, and the statement of the Chairman—that this mineral had come in the place of the partial failure of other means of lighting—he (Mr. Wilson) thought that hardly did justice to the importance of the subject, for it was not only in sperm and other mineral oils, but also in vegetable oils that the supplies were not nearly keeping pace with the existing demand for such materials. As people became more civilised they washed themselves more, and the demand for soap was greater; as the people became more educated they read more, and there was a greater demand for artificial light; and it was evident that, if the diminution of the supplies of these substances, animal and vegetable, had continued to the same extent as at present without these valuable mineral sources being made available, we should have had to pay very dearly for our lighting materials.

Mr. PHILIP PALMER mentioned that a friend of his sustained the loss of a very valuable portfolio of engravings through their being set on fire by the upsetting of a lamp upon them through the mere slamming of a door. He thought accidents from these lamps might in a great measure be obviated by there being a larger base for the lamp to stand upon, and also by weighting it to a considerable extent, so as to increase the steadiness.

Dr. MARCET, in reply upon the discussion, said with regard to Mr. Young having been the inventor of the lamp, he stated he believed that was the case, but if he was in error on that point he was happy to stand corrected. With regard to the Rangoon oil, he fully admitted its importance—the more so from the very able investigations of Mr. De la Rue and other gentlemen. With respect to the lamps being constructed of non-conducting materials, he attached the highest importance to this. Lamps of metal were certainly more or less dangerous, and he could easily understand that the oil, volatilised by the heat of the metal, would be liable to take fire and explode. With regard to the less degree of danger with petroleum than with coal gas, remarked upon by Dr. Bachhoffner, all he said was that on the first public introduction of coal gas it was received with great alarm, and a strong opposition was raised up against it, but that opposition was overcome, and gas was now the most extensively used method of lighting. With regard to petroleum giving out less deleterious matter than other lighting agents, he made that assertion upon the authority of Dr. Frankland, who was known to be a most careful and trustworthy experimenter, but he (Dr. Marcet) had not made any personal investigation into the matter.

The CHAIRMAN said he would now propose, what he was sure would be very acceptable to the meeting—viz., a vote of thanks to Dr. Marcet for his admirable paper on this subject. One point he begged to submit to the consideration of the meeting in relation to the question of danger—it seemed to him that the properties of a substance, irrespective of the manner in which it was used,

really did not enable them to judge whether it was dangerous or not. The only way in which we could form an opinion of the danger of any operation would be by knowing, not only the materials used, but also the exact way in which they were used. It would be readily assumed that, on board a ship like the *Warrior*, there was more perfect discipline and system in everything than in ordinary households, and, therefore, if any place were safe for the introduction of such a system of lighting as had been alluded to, this was so. Probably the generator was stowed in some out-of-the-way part of the ship—it might be far below the water line—and the vapour was conducted by pipes to the parts of the vessel where it was burnt; under such conditions the element of danger might be reduced to its smallest possible limit, and the use of that volatile substance under such circumstances was far more safe than in the hands of careless servants or other persons in ordinary households. He knew personally nothing of the particulars of the lighting of the *Warrior*, but he thought the meeting would agree that to consider the nature of the substance alone, without knowing the manner in which it was used, was not sufficient to form a correct opinion on the subject.

A vote of thanks to Dr. Marcet was then passed.

Proceedings of Institutions.

BROMSGROVE LITERARY AND MECHANICS' INSTITUTION.—The report for the year 1863 speaks of satisfactory progress. The adult evening classes have been successfully carried on, and to the superintendent, the Rev. R. Mumford, and the voluntary teachers who have so kindly aided him in his zealous endeavours, the committee have to express their thanks. These classes meet twice a week. The working men's cricket club has also been carried on with success. The school of art in connection with the Institution, has continued in a satisfactory state, and now numbers about sixty pupils. The French class has not been so well attended as could be desired. The class for instruction in vocal and instrumental music is at present in abeyance. The committee regret the loss of the services of Mr. Marcus, as honorary secretary, as he has ever been most active in furthering the objects of the Institution. The number of members is now 335, being a rather smaller number than last year; of these 114 are working men. The issues of books and magazines during the year have been 6,300, instead of 4,400 the previous year. The funds of the Institution are in a satisfactory state; the receipts were £204 18s.; the balance against the Institute is £9 10s. At the recent examinations in connection with the Worcestershire Union, various members obtained prizes. The annual soirée was held in the Corn Exchange, on the 8th of February, under the presidency of Viscount Ingestre, M.P. On the platform were the Earl of Shrewsbury and Talbot, Lord Lyttelton, the Hon. and Rev. J. W. Leigh, the Hon. and Rev. H. Douglas, H. F. Vernon, Esq., M.P. (the president of the Institution), Rev. G. W. Murray, and others, many of whom addressed the meeting, which was largely attended.

EBBW VALE LITERARY AND SCIENTIFIC INSTITUTION.—Prizes are offered for essays on the following subjects:—English.—1st. The advantages to be derived by working men from their connection with well-constituted benefit clubs. 2nd. Self-dependence. Welsh.—1st. Y manteision deilliedig i'r dosbeirth gweithiol oddiwrth gymdeithasau darbodus o gyfansaddiad da. 2nd. Hunanyddibyniaeth. First prize for each subject, £3; second ditto, £1 10s. The adjudicators are—English, the Rev. Evan Lewis, M.A., Aberdare; Welsh, the Rev. Dr. James, Santeg. The conditions of competition are:—All compositions to be those of persons who maintain themselves by manual labour, and who have been members of the Institution during 1863 and 1864. The length of

the essays not to exceed 500 lines of foolscap paper, and to be written in a legible hand on one side of the paper only: each paper to be distinguished by a motto, and the real name of the author to be written on a blank leaf, folded and sealed. All quotations to be distinguished by inverted commas. If the committee so decide, the successful compositions to be read at the annual soirée, or on some other convenient occasion. All compositions to be sent to the honorary secretary on or before the 3rd March, 1864.

FARNHAM YOUNG MEN'S ASSOCIATION.—On the 1st of February a lecture was delivered, "On the Sources of the Nile," by Rev. T. D. Wickham, M.A., of Holmwood, Dorking. The lecture was illustrated with diagrams. The Bishop of Winchester occupied the chair.

Fine Arts.

SCHOOLS OF ART AND INDUSTRY IN FRANCE.

In the *Journal* for the 25th of December last was published the decree containing the regulations relating to the recent re-organisation of the Schools of Art in France, and it may now be interesting to trace the origin of this important movement. It appears that in July last M. Rouher, the Minister of Agriculture, Commerce, and Public Works, addressed a letter to the Emperor, in which he submits for His Majesty's consideration the subjoined facts and propositions:—

"The results of the International Exhibition of 1862 proved that, if new and rapid progress was not made in art education, France would be surpassed by her rivals. This fact, the French section of the International Jury considered of sufficient importance to draw the particular attention of your Majesty to it, by which means it is intended to develop artistic and professional education in this country. The time has now arrived when measures should be taken, and a special commission of inquiry should be named.

"France is not entirely without professional studios and schools of art, but their systems are so at variance with each other, that they do not afford any means of giving gradual and methodical instruction. For instance: The Central School of Arts and Manufactures offers instruction applicable to all; the Imperial schools of mining, of bridges, and construction, however, are only open to free students, who apply themselves simply to mining and construction. In taking count of the number of students who go out each year from these establishments into active service, it is found that they bear but a small proportion to those in the same profession not so educated; nevertheless, in reality this number would suffice for all wants, and at first sight it would not be deemed necessary to increase the number of these schools; but though the subjects taught in these establishments are useful auxiliaries to industrial work, they are not numerous enough, and a demand should be made for the establishment of other schools for instruction in other subjects. It is necessary, then, in establishing these schools, to consider how they should be organised, and the commission will therefore have to make a programme of proposed rules, &c., for their administration.

"One of the chief points to be considered is instruction in drawing as applied to industry.

"A committee, formed from the French section of the International Jury, laid great stress upon the subject of industrial education; and M. Merimée has, with the unanimous consent of the committee, called the serious attention of the French Government to the necessity of proper measures being taken to protect the interests of the country. 'Since the Exhibitions of 1851 and 1855,' their report says, 'immense progress has been made throughout Europe; and although it cannot be said that we have remained stationary, yet we cannot deny the fact

that the advance we have made is not so great as that made by other nations. Reviewing the recent successes obtained by our manufacturers, we ought still to remember that defeat is possible, and that the only way to guard against it is to preserve our superiority and persevere in bringing our works to the utmost perfection.' The committee say further, that the instruction, such as it is, in the school at Paris, and in the secondary schools in the rest of the empire, is not such as to supply the want felt by the middle and working classes. These are the principal points into which the commission would have to inquire."

M. Rouher then proceeds to nominate the Commission, which includes M. Michel Chevalier, Senator; M. Le Play, Counsellor of the State; General Morin, Director of the Conservatoire des Arts et Metiers; M. Tresca, Under-Director of the Conservatoire des Arts et Metiers; M. Piedmont, Director of the Imperial Central School of Arts and Manufactures; M. Arlès-Dufour, Member of the Chamber of Commerce at Lyons; and other distinguished names.

THE LATE EUGENE DELACROIX.—An interesting sale is now going on in Paris consisting of a large number of original pictures, replicas, cartoons, nearly 6,000 sketches of various kinds, lithographs on the stone, etchings on steel and copper, and miscellaneous productions of the late Eugene Delacroix, together with a small collection of the works of other artists in the possession of the deceased, and the utensils and materials from his atelier. The catalogue contains no less than 858 lots, being divided into three series. The first of these includes a large collection of the sketches and cartoons of the numerous and remarkable decorative works of art executed by Delacroix in Paris and other places. Conspicuous amongst these are the works in the Chamber of Deputies, the Palais de Luxembourg, the ceiling of the Galerie d'Apollon in the Louvre, that of the Hotel de Ville, and the mural paintings in the churches of Saint Sulpice and Saint Denis du Saint-Sacrement, most of which are well known to all lovers of art. Next come nearly fifty original paintings, with a few finished sketches of his larger works, including the Battle of Nancy; the Battle of Faillebourg, won by Saint-Louis, now at Versailles; and a variation of his famous work, the Assassination of the Bishop of Liège by the Wild Boar of Ardenne. The original pictures, properly so called, include "La Sibylle" and other works, exhibited in 1845, and again in 1855, at the great Paris exhibition. After these come no less than thirty-two unfinished works, the subjects being principally sacred or mythological. The next division of this first part consists of twenty smaller sketches, like all the preceding, in oil; many of these have never been executed as finished pictures, and of those which have been so carried out, the sketch, or rather variation, of his well known *Médée furieuse*, in the Lille museum, and that of the *Chasse aux Lions*, at Bordeaux, are the most remarkable. Following these are from twenty to thirty copies and studies, by Delacroix, from the great masters, Raphael, Paul Veronese, Giorgione, Rubens, and others. Some of these, especially the last named, are charming works. The next division contains a large number of delightful studies from nature, many of them of considerable dimensions, and exhibiting the beauties, and in some cases the defects, of the artist in a remarkable manner. The first part of the catalogue concludes with a number of paintings by other artists, those of his friend Géricault being the most numerous, and consisting principally of copies from the old masters. There is a forest scene by Diaz; a young Greek, by Louis Boulanger; a bust by Jordaens; and a copy, by Planet, of Eugene Delacroix's own picture of the Jewish Wedding, now at the Luxembourg. The second part of the sale consists of water colour and other drawings, and sketches of all kinds, and presents almost more attraction to the connoisseur than the former. This

portion of the collection may be described as presenting almost a complete history of Delacroix's artist life, of his various styles, and of his aspirations as well as of his attainments. It includes a large number of decorative works, the sketches, in fact, of almost every important one that he ever executed, together with many never carried into execution; sketches for his Dante, Shakespeare, Goethe, and Byron pictures; his delightful studies in Spain, Algeria, Morocco, Arabia, Turkey; seventeen water-colour drawings, and twenty-two sketches taken in England in the year 1826, principally from the banks of the Thames, and on the sea coast; landscapes, fruit and flowers; and a large collection of studies of animals, especially lions and tigers, for which he seemed to take a special liking, and which he drew with an amount of animation and savage grace and beauty that has certainly never been surpassed. Lastly, in this series are no less than fifty-seven albums and pocket-books crammed with sketches and notes, in colours, sepia, pencil, and pen and ink, from his early youth down to the last years of his life. The third portion of the sale consists of engravings and lithographs, the most remarkable being the series of thirteen stones with subjects from "Hamlet," executed by Delacroix between 1834 and 1843; three others also from "Hamlet," unpublished; and four from "Götz de Berlichingen." The pictures and sketches are fetching enormous prices. The following are a few of the most noticeable items:—The original design for the grand ceiling of the Galerie d'Apollon in the Louvre was withdrawn by the representatives of the deceased, and a replica fetched no less than £206, while the first draft of the same, in oil, but measuring only about 2 feet by 18 inches, produced £40. The original sketch of the ceiling at the Hotel de Ville fetched rather more than £50. The sketch for the picture of King Jean at the Battle of Poitiers, produced £138; that of the Battle of Nancy, £180; of the Battle of Taillebourg, the large work at Versailles, £300; the Sybille, exhibited in 1845 and at the Paris Universal Exhibition of 1855, £134; the Wounded Cuirassier on the field of battle rising between two dead horses, a very small but most remarkable picture, £124. Four large pictures of flowers, which attracted great attention in Paris in 1849 and 1855, fetched together £1,020. A copy by Delacroix of the portrait of the Youth in black by Raphael, in the Louvre, fetched £130; one of the Belle Jardinière, £200; and one of the Miracles of Saint Benoit, of Rubens, £260. Two days' sale, 249 lots, realized between £7,000 and £8,000.

NATIONAL GALLERY OF IRELAND.—This gallery, which was formally opened to the public on January 30th, is built on the lawn of the Royal Dublin Society in Dublin, and forms a pendant to the New Natural History Museum. It has been constructed on the principle of top lighting, so successfully realized in the gallery built for the Sheepshanks collection. This principle is equally applicable to private as to public galleries, to large as to small rooms. It requires that the width and the height of the room should be the same, and the space for the skylight half the width. Thus, if the width of the floor be twenty feet the height should be twenty feet, and the skylight ten feet in the centre. A picture properly hung in such a room cannot have any glitter and must be perfectly seen. Mr. Sheepshanks very nearly arrived at settling this principle in his own private gallery at Rutland Gate, from which he himself assisted to cart his pictures to the South Kensington Museum. But it was Mr. Redgrave, R.A., who reduced the principle to the simple formula, and Capt. Fowke, R.E., who successfully carried it into practice at the South Kensington Museum, at the Exhibition of 1862, and now in the National Gallery of Ireland.

THE HOTEL CLUNY.—A new room has just been opened in the museum of the Hotel de Cluny, in Paris, which is devoted to French *faïence*, the production of the old potteries of Nevers, Rouen, Marseilles, and Strasbourg,

and which contains already more than six hundred specimens of various kinds. The most striking objects are:—A magnificent Rouen chimney piece, ornamented with blue designs on a white ground; a small circular table or guéridon, of the same ware, in one single piece, richly ornamented in the style of Louis XIV., with medallions and arabesques; a large inkstand, with Chinese ornaments, an early attempt to imitate the porcelain of Asia; and a stove in form of an ancient altar, of Nevers make, ornamented with rams' heads, and otherwise decorated. The cases are filled with a numerous collection of objects; enormous tureens, flower vases of most eccentric forms, fancy ornaments in the form of children, fruit, a cobbler at work in his stall, a small sedan chair bearing the arms of the Dauphin, and many more. Against the wall are a number of fontaines, or small tanks, of various forms, some of them very elegant, and a clock of Strasbourg ware, of the time of Louis XV. In another part of the room is a stand, on which is a curious collection of specimens; plates with fruit, asparagus, and other objects in relief, tureens, and other articles in the form of turkeys, fowls, pheasants, and other birds, in some instances exhibiting brilliant colours. Two plates of Rouen ware are decorated with sonnets, music as well as words. This new room adjoins that which is called the *Galérie des Couronnes*, on account of the nine golden crowns contained therein. These nine crowns were found, in 1858, by a French officer, at Fuente-de-Guerrazar, near Toledo, and are said to have belonged to the Princes of the Goths, and to have been buried probably in the commencement of the eighth century, or about the time of the invasion of the Peninsula by the Arabs. They are massive objects, and in excellent preservation. As to the ornamental earthenware above referred to, there is a perfect furor for it in Paris at the present moment; a soup tureen and stand of Rouen ware fetched 4,000 francs the other day, and a plate of the same fabric 1,200 francs. But the most remarkable instance was that of a candelabrum, forming part of the celebrated service of "Henri II.," from the collection of Madame de Sayette. This curious piece is of a monumental form, is richly decorated with arabesques in enamel, figures supporting the arms of Henri, human masks, heads of cherubim and lions, and garlands of flowers, and fetched the enormous price of 13,500 francs. There are seven pieces of this service in the museum of the Louvre and that of the Hotel Cluny. Baron Rothschild and M. de Pourtales each possess one sample. It will be remembered that about twenty pieces, all the rest known, were exhibited at the Kensington Museum in 1862. At the same sale an enamel cup, bearing the monogram of Leonard Limousin, and ornamented with the arms of Léon and Castile, fetched 10,650 francs.

COPYRIGHT.—On the 3rd instant Mr. Black obtained leave to introduce a bill for the consideration of the acts relating to copyrights in works of literature and the fine arts, and the bill was brought in and read a first time.

Manufactures.

STEAM BOILER EXPLOSIONS.—The ninth annual report of the Manchester Association states that at the close of the year 1863, there were under inspection, at 552 factories and other works, 1,458 boilers and 1,090 engines. The gross indicated horse-power of all the boilers under inspection may be stated approximately to be 131,014. The defects discovered in boilers are mainly of two distinct classes—one relating to their construction, and the other to their condition. Under the first head, that of construction, numerous recommendations have been made; in many boilers the internal tubes have been recommended to be strengthened by hooping; in others it has been suggested that the shells be strengthened at the steam dome, by stays of angle iron, &c.; in others, that the shell be strengthened at the ends; in others

the load on the safety-valves has been recommended to be reduced. The defects appertaining to the second head, viz., that of condition, were fracture of plates and angle irons, blistered plates, furnaces out of shape, corrosion, defective safety-valves, defective pressure gauges, defective water gauges, defective feed apparatus, defective blow-out apparatus, over pressure, and deficiency of water. The defects not actually dangerous, were fracture of plates and angle irons, blistered plates, furnaces out of shape, corrosion, safety valves out of order, pressure gauges out of order, water gauges out of order, feed apparatus out of order, fusible plugs out of order, over pressure, and deficiency of water. Corrosion and fracture are among the most important defects met with, and there were as many as 202 cases of corrosion, 22 of which were dangerous; and 62 of fracture, 11 of which were dangerous. Surface blowing-out has made considerable progress during the past year, and is now adopted by 58 members, and applied to 129 boilers. Very many of the applications of the surface blowing-out apparatus have been attended with great success, while some have not fully answered the expectation formed. The success has been greatest with muddy and sludgy waters, while common soda continues to be used with great and considerable advantage, and is found to loosen the old scale, as well as to prevent the formation of new. The number of explosions which came under notice during the year 1863 was 47. During the year there were 76 persons killed, and 80 others injured. All these accidents have happened to boilers not under the inspection of the Association, with the exception of one instance, in which case it appears, however, that facilities for thorough examination were not afforded. The causes of the 47 explosions which occurred in 1863 may be classified as follows:—14 were due to defective construction; 4 boilers failing in the shell, and 10 collapsing in the furnace tube, not from over-heating, but simply from weakness of the flue. 7 were due to defective condition of the boiler. 6 to failure of the seams at the bottom of externally flued boilers, over the furnace. 4 to shortness of water, occurring through neglect. 2 to overheating of plates, consequent upon an accumulation of sediment. 2 to excessive pressure. 1 was purely accidental. For every explosion that occurred through immediate neglect, at least four arose from the weakness of the boilers themselves, or insufficiency of their arrangements. The whole of the explosions caused by the collapse of internal flue tubes might have been prevented by the adoption of the approved means of strengthening them, such as water-pockets, flanged seams, or hoops, as well as by other well-known means. Attention is called to the large number of explosions found to result from "failure of the seams at the bottom of externally-fired boilers." Several causes combine to produce this effect. One, to which especial attention should be directed, is the admission of feed-water. This is sometimes allowed to impinge immediately upon the plates over the furnace. To prevent this, the feed pipe should be carried along horizontally for several feet and at a few inches below the surface of the water, being perforated with small holes throughout its entire length, so that the feed may be dispersed on its introduction. A second cause is the imperfect way in which these externally-fired boilers are too frequently repaired. One-sixth of the whole number of explosions appears to have been due to corrosion, by which the plates were eaten away until their thickness became so reduced that rupture ensued. Of these cases, 6 were external, and occurred in stationary boilers, while 1 was internal, and occurred in a locomotive, so that no instance of an explosion happening to a stationary boiler on account of internal corrosion was met with during the year. A very general impression exists, that all explosions arise either from excessive pressure, induced by a reckless tampering with the safety-valve, or else from the shortness of water. This opinion appears to be incorrect, for out of 36 explosions only 2 arose from excessive pressure, and 4 from shortness of water. The position at which rupture in the shell of a

boiler commences on the occurrence of explosion is a matter of interest, and it has been thought by some to exercise an important influence on its destructive character. In the 36 explosions accounted for, the rents of five boilers commenced above the water line; in a sixth, the boiler was so completely destroyed that it was difficult to determine which of the rents was the primary one; in a seventh, the boiler exploded while under test by steam alone, without water, so that consideration of this case may be dismissed; while in the 29 remaining ones, the boilers all rent primarily below the water line. In conclusion, the report says that the experience of the past year affords additional evidence of the soundness of the system of periodical boiler inspection, which this Association has both inaugurated and maintained, as well as of its sufficiency for the prevention of boiler explosions. Of this, many special illustrations were met with during the year, in which impending explosion was averted, the boilers being found, on inspection, to be in a most dangerous state, although the fact was entirely unsuspected by their owners.

COPPER PAINT.—The *Mining Journal* states that a new pigment, calculated at the same time to increase the resources of the decorative painter, and to afford a ready means of preserving iron and other metals, has recently been introduced at Paris by Mr. L. Oudry, of the Anteuil Electro-Metallurgic Works. He first obtains an absolutely pure copper by throwing down the metal by the galvanic process; he then reduces the precipitate to an impalpable powder by stamping. This powder is then combined with a particular preparation of benzine, and used in the same way as ordinary paint; beautiful bronzed effects are produced upon it by means of a dressing with acidified solutions and pure copper powder. The articles painted with the new material have all the appearance of electro bronze, while its cost is less than one-sixth; it will last from eight to ten years. Mr. Oudry also proposes to substitute benzine oil for linseed and other oils, over which it possesses great advantages.

Colonies.

THE CUSTOMS RETURNS at the port of Sydney show a considerable falling off in the revenue from July to October. As, however, there was in the first six months of 1863 a great increase, as compared with 1862, there is still a satisfactory increase of 5 per cent. on the ten months ending October, 1863; the amount of revenue being £545,809 8s. against £519,401 9s. 8d for the same period of 1862.

THE POST OFFICE MONEY ORDER SYSTEM in Sydney appears to work well, and each mail shows a steady increase in the issue of money orders upon the United Kingdom. The money orders sent by the September mail were 489, the amount being £2,093 6s. 7d. By the October mail there were remitted 591 orders, amounting to £2,233 16s. 1d.

ADELAIDE LABOUR MARKET.—The wages now offering to female domestic and dairy servants are—Barmmaids, £28 to £30; dairymaids, £19 to £23; general servants, £18 to £23; good cooks, £26 to £30; housemaids, £21 to £25; kitchen maids, £19 to £22; nurses, £15 to £26; laundresses, £26; superior general servants, £26 per annum, with board and lodging.

GOLD.—A private letter from Vancouver's Island, dated November, says that business has considerably improved in the last few days on account of the discovery of some promising gold fields within ten miles of Victoria, which has created a general rush on the part of all the mining population. It is calculated they will realize, on an average, at least 5 dols. per diem.

EMIGRATION TO NEW ZEALAND.—A pioneer party of emigrants, in connexion with the Church of England Emigration Society, left England lately. This society has been established for the purpose of superintending

a system of emigration to New Zealand, with the view of giving to its members the benefit of co-operation in emigrating to a special settlement. The society has availed itself of the land-order system of Auckland, and the authorities of that province have promised every assistance. A block of land in the north of the province, where the natives are not in rebellion, has been reserved for the Society's emigrants.

DUTCH TRADE WITH AUSTRALIA, &c.—During the last year nine vessels from Holland arrived at Melbourne, bearing 86,300 cases of Geneva, 37,744 boxes of candles, 6,945 quarters of oats, besides other goods; and there were still, at date of latest letters, 7 vessels on voyage to Melbourne, with 135,954 cases of Geneva and 22,002 boxes of candles; one vessel for Sydney, with 15,600 cases of Geneva and 5,250 boxes of candles; also one vessel for Otago, with 4,830 cases of Geneva, 750 quarters of oats, and other goods.

STAVES FOR CASKS.—It is said that a new kind of industry is likely to spring up at Hobart-town, in the manufacture of staves for casks. These staves are of the silver wattle, of which there is an abundance in every way adapted to the purpose. Some beef sent home from Victoria and brought back again in casks made out of old wine casks with oak staves, was found to be far inferior to that in which the silver wattle was used. The pickle in the former was discoloured, but in the latter bright and clear, and the beef far superior as a merchantable article.

EXPORT OF GRAIN FROM SOUTH AUSTRALIA.—The exports of flour and wheat from Port Adelaide and the outports during the first three quarters of 1863, compiled from the returns published in the Government *Gazette*, were 32,280 tons of flour and 106,619 quarters of wheat, showing an increase upon the exports of any similar period since the formation of the province. Calculating 45 bushels to a ton of flour, this would make the exports of breadstuffs, up to the end of September, equal to 51,234 tons of flour. The entire wheat crop of last harvest was supposed to be equal to 85,374 tons of flour. The demand for local consumption would leave the quantity available for export about 60,000 tons.

Obituary.

WILLIAM DYCE, R.A.—The year has begun badly for the Royal Academy, bereaving it of one of its most active and valuable members, one of those highly-educated painters whom it could ill spare, and will not readily replace, either in regard to his work in the council, or that more important part of an Academician's life which appears by its results on the walls of the exhibition rooms. Dyce's services to the Academy were considerable, and often timely; it was he who proposed the institution of that admirable safety-valve—the class of retired Academicians, —which, by creating vacancies in the more active section of the body without diminishing the honour due to those who entered the new grade, enabled the association to add men to its ranks who must otherwise have waited until death created vacancies. It is not too much to say that Dyce, although not a prolific painter, did, by the usually high character and aims of his works, much more to maintain the position of the association than it is the fortune of most of his brethren to be able to perform. The Royal Academy Exhibition contained, in 1844, that picture which may be considered, on the whole, as the best of Dyce's works, "Joash shooting the Arrow of Deliverance," showing how the dying Elisha guided the hand of Joash, King of Israel, in shooting the arrow of the deliverance from Syria. Notwithstanding the dry manner of this picture, which was to a certain extent the inevitable outcome of the painter's system, it possessed qualities of design, drawing, and expression such as it is to be hoped we shall often see in the English school of art. It is precisely in this

severe direction of study and execution that our artists need practice. It is understood that Dyce contemplated to extend the subject of the above-named picture, so as to form a series of compositions, having the death of Elisha for central point, and to comprise the visit of Joash weeping for the "chariot of Israel and the horsemen thereof," to Elisha, the taking of the bow, the smiting of the arrows, that remained after that of deliverance had been shot, upon the ground, whereby the triple victories of Israel were assured; and, lastly, the recalling to life—at the touch of Elisha's bones—of the dead man whose body had been cast into the tomb of the prophet; a grand series of subjects. That period of Dyce's life which was employed in the production of this picture was undoubtedly his prime; to it were due the design, at least, if not the execution of his "Baptism of Ethelbert," now a fresco in the House of Lords. In this period was begun "St. John leading home his adopted mother," which, at its late exhibition in the Royal Academy (1860), somewhat re-established the professional position of the painter, who, soon after its commencement in 1844, seems to have felt the earliest signs of the disease which, after sapping his energies for years, terminated his life on the 14th inst. In the meantime he had carried on a large series of works successfully, although he was not at last able to complete the largest, if not the most important of all, *i.e.*, "King Arthur's Court," in the Robing-Room at Westminster. William Dyce was born at Aberdeen, in 1806; he was the son of a physician, and educated at Marischal College. At about seventeen years of age he became a student in the Royal Scottish Academy, Edinburgh, having shown some signs of ability in art before that time. Three years after this he came to London, and entered the schools of the Royal Academy as a probationer, but, disliking the system of education—then, we believe, under the charge of Henry Thompson, R.A., he went to Rome, without becoming a student. At Rome Dyce studied the works of those masters whose tastes and methods of execution most happily assimilated with his own predilections, *e.g.*, the painters of the Tuscan and early Roman schools. The *bravura* of the later Romans was not more to his taste than were the mildness and genial affectations of Henry Thompson. In 1826, Dyce returned to Scotland, and soon afterwards sent his first picture to the Royal Academy; this was, "Bacchus nursed by the Nymphs." Again he went to Rome, and from thence sent to the same exhibition "The Madonna and Child." In two years he was at Edinburgh, and painting portraits—in which, especially those of women and children, he excelled—but at the same time endeavouring to make his way as an historical painter by contributing pictures to the Royal Scottish Academy's Exhibition. In 1836 he sent to the Royal Academy's Exhibition "The Descent of Venus," from Ben Jonson's Masque, "Love's Triumph through Callipolis." The strong point of Dyce's character, appearing even in his practice of art, was an intense feeling of order, or logical arrangement and system. This qualified him to deal with many literary subjects, and made him powerful with his pen and in debate. The most effectual result of this faculty was a pamphlet on Art-education, which appeared in 1837, and procured Dyce the offices of superintendent and secretary to the committee charged with the management of the Schools of Design. While in this office he made a report on the Continental systems for diffusing Art-education among the people, which remained for some time a text-book in this country. In 1844, Dyce resigned his connection with the schools of Art. He was elected A.R.A. in 1844—the year of painting "Joash shooting the Arrow of Deliverance"—and Royal Academician in 1849. In 1846 he began the fresco, "Neptune assigning to Britannia the Dominion of the Seas," a sufficiently absurd subject. In 1847 he began "The Baptism of Ethelbert." In 1818 the series of frescoes in the Robing-Room at Westminster, from "The Legend of King

Arthur," was begun; and about the same time the painter was, with others, commissioned to execute a fresco in the Summer-house of Buckingham Palace, the subject being from "Comus." About 1850, the paintings in All Saint's Church, Margaret-street, were begun. Dyce wrote several pamphlets on art subjects, and was an active champion of his own views in art, which had, to say the least of them, a strict logical consistency, and if men would but be bound by logic only, were absolutely perfect. He was founder of the "Motett Choir," now merged in the Ecclesiological Society, and intended for the revival of ancient church music. The most valuable of Dyce's works, excluding those above named, are as follows:—"Titian and Irene da Spilembergo" (1840), "Madonna and Child" (1846, Manchester, 1857), "The Meeting of Jacob and Rachel" (also at Manchester, 1857), "King Lear and the Fool in the Storm" (1850), "The Man of Sorrows," and "Pegwell Bay" (1860).

Publications Issued.

STATISTICS AND OBSERVATIONS ON THE MINES OF CORNWALL AND DEVON, illustrated by maps, plans, and sections. By Thomas Spargo. (*Vincent and Green.*) The statistical statements are framed to elucidate the products and realised prices of the ores raised in the respective mining districts for the years 1860 to 1862 inclusive. A classification is made of the various mines in each district, illustrated by ground-plans, distinguishing the mines in each class; and in many instances the observations of the writer embrace an account of the condition and prospects of the mine to which the reader's attention is called. The tables are stated to be founded on data furnished by each mine, and show the quantity of tin, copper, and lead ore raised in the respective districts, and of the lead yielded and silver extracted in each lead mine.

Notes.

SCHOOL OF NAVAL ARCHITECTURE.—For the first time since Sir James Graham was First Lord of the Admiralty, a vote is to be submitted to Parliament for a School of Naval Architecture. And at p. 28 of the navy estimates for the year 1864-5, recently laid before Parliament, appears a sum of £2,300, "for School of Naval Architecture and Maintenance of Students in the same." The discussions which have taken place in the house of the Society of Arts have provoked this result. Government has not yet furnished any further particulars of its intentions in this matter; but a report is current that the school will be opened, not merely for the use of the navy, but also for the mercantile marine, and that it is to be organized on a self-supporting system as far as practicable. It is said that the students not paying fees will be admitted by open competition.

EMIGRATION FROM GERMANY.—During the year 1863 the number of emigrants from Hamburg was as follows:—To New York, 15,692; Quebec, 2,674; Australia, 2,525; Brazil, 799; Chili, 176; and 2,815 went indirect; total, 24,681, against 20,077 in the year 1862. From Bremen, the emigration was:—To New York, 16,373; Baltimore, 1,085; Brazil, 86; Chili, 408; total, 17,952, against 14,710 in 1862.

TRADE MARKS.—The Board of Trade have published in the *Gazette* of the 12th of February the following translation of Article 258 of the Saxe-Coburg Penal Code, relative to trade marks, which has been recently adopted by the Duchy of Nassau:—"Whoever imitates stamps or particular marks by which wares or manufactures of a particular house of business, or of a particular manufactory, are indicated, and whoever uses them or the label of a house of business for the purpose of deceiving the trade, is subject to a punishment of imprisonment for a period not

exceeding two months, it being understood that the prosecution be instituted at the instance of the house in question." This decision applies not only to natives but also to foreigners.

SUBMARINE VESSEL OF WAR.—Experiments were recently made in the port of Rochelle to test the qualities of a submarine vessel of war, the invention of Captain Bourgeois, of the French navy. The vessel was stated to be so constructed as to admit of being almost instantly submerged by compressed air and a peculiar apparatus with which it was provided. The only part that remains visible is a small tower, whence the commander may observe the position and motions of the ship to be attacked, and direct his men which way to steer in order to strike her hull with the formidable spur which constitutes the chief means of attack of the new contrivance. The experiments were not satisfactory, but the first trial met with indulgence from the spectators, it being the opinion of many present that, with some improvements, the new contrivance might become a terrible engine of war.

VACCINATION OF SHEEP.—Mr. Lowe stated in the House of Commons, on Tuesday evening last, that the experiments which had been instituted by the Government were concluded, and that the result was not satisfactory. The report would be ready by Easter. The experiments were of two kinds. In the one the sheep were vaccinated with lymph taken from the human subject. That method had succeeded up to a certain point. The sheep took the disease, though in an irregular and abnormal form. When, however, they came to test the use of the vaccination thus effected, it was found that the sheep freely took the disease afterwards, either by inoculation or in the natural manner, from other sheep. The second experiment was to inoculate with matter taken from sheep suffering under small pox, in order to produce a vaccine disease which would stand in the same relation to sheep as cow pox to the human subject. They had entirely failed in producing that disease in the cow.

MULREADY EXHIBITION.—The arrangements for the Mulready Exhibition at the South Kensington Museum are sufficiently advanced to enable it to be opened to the public on Saturday, the 12th of March. The private view will take place on the previous day (Friday). Great liberality has been shown by the proprietors of Mr. Mulready's works, headed by Her Majesty and H.R.H. the Duke of Cambridge, in consenting to lend them for exhibition; and a large collection of his finished pictures, sketches, studies, and drawings, arranged as far as possible in chronological order, will be displayed on the walls of a portion of the Museum galleries.

MEETINGS FOR THE ENSUING WEEK.

- MON.** ...British Architects, 8.
Actuaries, 7. Mr. J. Meikle, "On the Determination and Distribution of Profits."
Medical, 8½. Dr. Edward Smith, F.R.S., "The Emission of Urea and other Excretory Products, under the influence of numerous agencies."
Pathological, 8.
R. United Service Inst., 8½. Capt. J. H. Selwyn, R.N., "Armoured or Iron-clad Ships: their Advantages and Defects."
R. Academy, 8. Mr. R. Westmacott, R.A., "On Sculpture."
TUES. ...Civil Engineers, 8. Renewed discussion upon Mr. Sopwith's paper, "On the Mont Cenis Tunnel."
Med. and Chirurgical, 8. Annual Meeting.
Photographic, 8.
Anthropological, 8.
Royal Inst., 3. Prof. Marshall, F.R.S., "On the Morphological Phenomena of Animal Life."
WED. ...Society of Arts, 8. Mr. Charles Tomlinson, "On the Verification of Olive Oil by means of its Cohesion Figure."
Pharmaceutical, 8.
R. Society of Literature, 8½.
THUR. ...Royal, 8½.
Antiquaries, 8.
Linnean, 8. 1. Dr. Hooker, "On the Identity of *Pinus Pence* of Macedonia with *P. excelsa* of the Himalaya." 2. Mr. S. Ward, "On the Double Cocoa-nut of the Seychelles." 3. Dr. H. Criger, "On the Fecondation of Orchids." 4. Rev. M. J. Berkeley, "On the Fructification of *Chionyphe Carteri*."

Chemical, 8. Prof. Abel, "On the Non-Metallic Impurities of Refined Copper."

R. Society Club, 6.

Royal Inst., 3. Prof. Marshall, F.R.S., "On the Morphological Phenomena of Animal Life."

FRI. ...Philological, 8.

Royal Inst., 8. Professor Stokes, "On the Discrimination of Organic Bodies by their Optical Properties."

R. United Service Inst., 3. 1. Lieut. A. H. Gilmore, R.N., "The Application of Electric Telegraph to the Steering and General Management of a Man-of-war." 2. Capt. H. F. McKillop, R.N., "Flexible Cofferdams for Cleaning and Repairing Ships afloat."

Archæological Inst., 4.

SAT. ...Royal Inst., 3. Prof. Frankland, "On the Metallic Elements."

R. United Service Inst., 2. Annual Meeting.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par.
Numb.

Delivered during the Vacation, 1863.

486. Transatlantic Telegraphic Communication—Return.
45 (VI.) Trade and Navigation Accounts (30th June, 1863).
487. Ordnance—Report from Committee.
383. Poor Relief—Report from Committee.
431 (A 1). Poor Rates and Pauperism—Return (A).
453. Army (Clothing Factories)—Returns.
466. Shanhai—Return.
468. Naval Prize Money, &c.—Account.
476. Canada (Military Equipments)—Return.
479. Friendly Societies (Scotland)—Report by the Registrar.
497. Army (Commissions)—Return.
511. Local Lighthouses—Paper.
504. Emigration—Return.
508. Colonial Governors—Return.
495. Dublin and Edinburgh Corporations—Return.
517. Broadmoor Criminal Lunatic Asylum—Paper.
532. Holyhead Harbour—Return.
482. Church Building and New Parishes Acts Amendment Bill—Report from the Select Committee.
424. Inland Revenue and Customs Establishments—Report.
494. Public Institutions—Return.
510. Goodwin Sands—Return.
528. Income and Property Tax—Returns.
539. Ecclesiastical Revenues (Durham)—Return.
542. Kingstown and Holyhead Mails—Return.
128. Highland Roads and Bridges—Final Report of Commissioners.
473. East India (Public Works Department)—Returns.
490. Rajah of Coorg—Correspondence.
503. Fines and Penalties (Ireland)—Abstract of Accounts.
523. Oude Claims Inquiry—Copy of Letter.
551. Jesuits—Return.
445. Holyhead Harbour—Report.
469. Imports and Exports, &c.—Returns.
478. Gas (Metropolis)—Accounts.
489. Lancashire, &c., Unions—Returns.
492. Railways—Return.
493. Import and Export Duties—Return.
512. Abeokuta—Letter from the Reverend H. Venn.
519. East India (Captain Frith)—Papers.
521. East India (Lieutenant Torckler)—Papers.
524. Oude Claims (Asoph-ul-Dowlah)—Memorial.
525. Stornaway Foreshore—Petition by Sir James Matheson.
530. Vessels and Tonnage, &c.—Return.
536. Navy (China Seas)—Return.
549. Metropolitan Rates—Return.
552. Coast Guard Stations—Returns.
555. Railway Trains (Redhill)—Returns.
45 (VII.) Trade and Navigation Accounts (31st July).
161. Public Health—Fifth Report of the Medical Officer of the Privy Council.
431 (A II). Poor Rates and Pauperism—Return (A).
451. Thames Conservancy, &c.—Report.
470. Sugar—Copies of Letter, &c.
500. Metropolitan Railway Communication—Lords (First Report).
500. Metropolitan Railway Communication—Lords (Second Report).
516. Standing Orders of the House of Commons.
153. Navy (Pay of Officers)—Return.
260. County Treasurers—Abstract of Accounts.
500 (II.) Metropolitan Railway Communication—Lords (Third Report).
502. Cloone Loan Fund—Correspondence.
543. Mail Service (Australian Colonies)—Correspondence.
556. Bankruptcy Court—General order.
310. Assurance Companies—Return.
457. Ecclesiastical Commission—Report.
522. East India (Army)—Return.
271. East India (Progress and Condition)—Statement.
499. Prison Discipline—Lords Report.
527. Savings Banks (Ireland)—Returns.
488. Timber in Dockyards—Return.
151 (I.) Rotherham Sanitary Condition—Report.
205. Grand Jury Presentments (Ireland)—Abstract of Accounts.

